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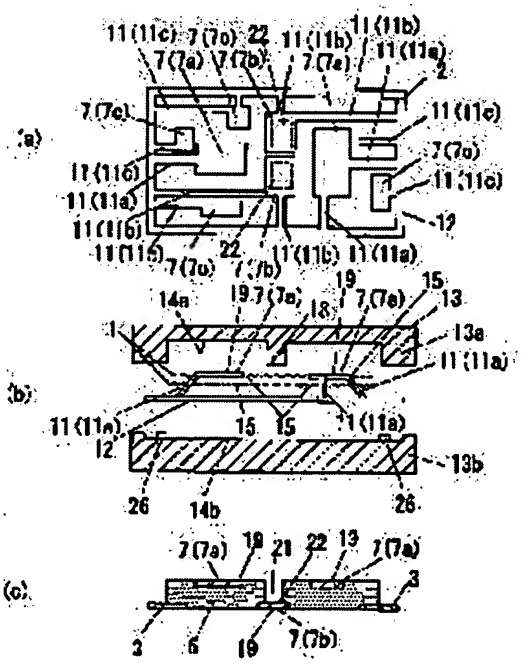
(54) HEAT-CONDUCTIVE RESIN COMPOSITION, PREPREG, RADIATING CIRCUIT BOARD AND RADIATING HEATING PART

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a heat-conductive resin composition which can obtain a molded product highly filled with an inorganic filler and having excellent thermal conductivity and can be suitably used in forming an insulating layer of a radiating circuit board and in forming an adhesive layer for fixing a metallic radiating element to a heating part.

SOLUTION: An inorganic filler having 30-60 pts.mass particles having an average particle diameter of 50-100 μm, 30-60 pts.mass particles having an average particle diameter of 5-30 μm, and 5-10 pts.mass particles having an average particle diameter of 0.1-3 μm is used. The inorganic filler is incorporated in an amount of 80-95 wt.% to render the thermal conductivity 3-10 W/mK.



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TI Heat conductive resin compositions, prepregs, and electric circuit board substrates and heating electric parts having good heat dissipation characteristics
IN Baba, Daizo
PA Matsushita Electric Works, Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 19 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
IC ICM C08L101-00
ICS B29B015-08; C08G059-62; C08K003-00; C08K003-22; C08K003-28; C08K003-36; C08K003-38; H01L023-36; H01L023-373
CC 37-6 (Plastics Manufacture and Processing)
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PRAI JP 2000-169569		20000606		

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 2001348488	ICM	C08L101-00
	ICS	B29B015-08; C08G059-62; C08K003-00; C08K003-22; C08K003-28; C08K003-36; C08K003-38; H01L023-36; H01L023-373
	IPCI	C08L0101-00 [ICM,7]; B29B0015-08 [ICS,7]; C08G0059-62 [ICS,7]; C08K0003-00 [ICS,7]; C08K0003-22 [ICS,7]; C08K0003-28 [ICS,7]; C08K0003-36 [ICS,7]; C08K0003-38 [ICS,7]; H01L0023-36 [ICS,7]; H01L0023-373 [ICS,7] <--

AB Title compns. comprise 80-95% inorg. fillers containing 50-100 μm-diameter particles 30-60, 5-30 μm-diameter particles 30-60, and 0.1-3 μm-diameter particles 5-15 parts and have thermal conductivity of their cured products 3-10 W/mK. Thus, a glass nonwoven fabric was immersed in a composition containing
ESCN
195XL4 1.5, Epikote 828 0.6, YPP 50 (phenoxy resin) 0.3, ESB 400T 1.0, Tamanol 752 1.5, tetraphenylphosphonium tetraphenylborate-phenol novolak reaction product 0.1, and alumina with specific particle diameter distribution 95% and precured to give a prepreg, three sheets of which were laminated with two Cu-lead frames and completely cured to give a elec. circuit board.
ST heat conductive resin compn filler elec circuit board; elec part heat dissipation heat conductive resin prepreg
IT Reinforced plastics
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(glass fiber-reinforced; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)
IT Crosslinking catalysts
Electric apparatus
Fillers
Lead frames
Printed circuit boards
Thermal conductors
Transistors
(heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)
IT Electric insulators
(heat conductive; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)
IT Adhesives

(heat-conductive; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT Reinforced plastics
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(inorg. fiber-reinforced; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT Nonwoven fabrics
(inorg.; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT Glass fiber fabrics
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(nonwoven; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT Epoxy resins, preparation
RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(phenolic, novolak, brominated; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT Reinforced plastics
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(prepregs; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT Phenolic resins, preparation
RL: CAT (Catalyst use); IMF (Industrial manufacture); PREP (Preparation); USES (Uses)
(resction products with tetraphenylphosphonium tetraphenylborate, curing catalyst; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT 9003-35-4DP, Formaldehyde-phenol copolymer, resction products with tetraphenylphosphonium tetraphenylborate 15525-15-2DP, reaction products with phenolic resins
RL: CAT (Catalyst use); IMF (Industrial manufacture); PREP (Preparation); USES (Uses)
(curing catalyst; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT 1309-48-4, Magnesium oxide, properties 1344-28-1, Aluminum oxide, properties 7631-86-9, Silica, properties 10043-11-5, Boron nitride, properties 24304-00-5, Aluminum nitride
RL: MOA (Modifier or additive use); PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
(filler; heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

IT 381718-37-2P 381718-38-3P 381718-39-4P 381718-40-7P
RL: IMF (Industrial manufacture); POF (Polymer in formulation); PRP (Properties); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
(heat conductive resin compns. for prepregs useful for elec. circuit board substrates and heating elec. parts)

* NOTICES *

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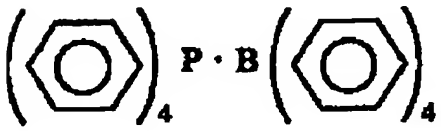
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the technique used especially for the power-electronics field about the heat-leakage nature exoergic components which made a metal plate, or a radiation fin and exoergic components unify through the heat-dissipation nature circuit board which made easy the high heat-dissipation nature and high-current-izing which are fabricated by the prepreg which comes to carry out sinking-in desiccation of the thermally conductive resin constituent which high-filled up resin with the inorganic filler, and this thermally conductive resin at a nonwoven fabric, and this prepreg and leadframe, and this prepreg.
[0002]
[Description of the Prior Art] Since a semi-conductor is integrated highly and this is mounted in high density in recent years with the demand of advanced features of electronic equipment, and the formation of a small thin shape, it has been required that the design which thought high heat dissipation nature as important should be easy for the circuit board which mounts these. Moreover, giving heat dissipation nature to the exoergic components (power chip) itself, such as advanced features and a transistor chip by which a high increase in power is being carried out, is also called for.
[0003] The circuit board which formed the circuit in the printed wired board formed with a glass base material epoxy resin laminated sheet through the insulating layer as the circuit board of such high heat-dissipation nature at both sides or one side of a heat sink which consists of the circuit board which consists of the so-called DBC (direct-bonding kappa) substrate which joined directly the circuit which consists of a copper plate to ceramic substrates, such as the circuit board and the alumina which prepared the radiation fin only in the loading part of exoergic components, and alumimium nitride, aluminum, copper, etc. is proposed.
[0004] Moreover, improving the heat dissipation nature from exoergic components was made about the exoergic components itself by making a heat dissipation nature sheet intervene mechanically between exoergic components, a chassis, etc.
[0005]
[Problem(s) to be Solved by the Invention] However, in what prepared the radiation fin in the printed wired board among the above-mentioned conventional techniques, it was what is bulky too much and cannot respond to small thin shape-ization of electronic parts.
[0006] Moreover, in the circuit board which consists of a DBC substrate, the dimension of a substrate was what will be regulated by property sides, such as cost and a mechanical strength, will be limited to a very small thing, and will be limited to a small module.
[0007] Moreover, it was what the upper limit of the thickness of the copper foil used for formation of a circuit when aiming at improvement in heat dissipation nature by the circuit board which formed the circuit in both sides or one side of a heat sink which consists of aluminum, copper, etc. through the insulating layer is generally about 105 micrometers, and it becomes difficult to form a circuit and cannot cope with the request to high-current-izing by etching processing if it becomes thick from this.

[0008] Then, while having arranged the heavy-gage leadframe and the heavy-gage heat sink by which circuit formation is made beforehand in metal mold, forming the circuit board which has the insulating layer which consists of a circuit which consists of a leadframe by injecting the thermoplastics with which metal mold is heated and it fills up with the inorganic filler, and thermoplastics was proposed, but since it was difficult to fill up an inorganic filler into thermoplastics with high density, it was difficult [it] to improve heat-dissipation nature.
[0009] Furthermore, spreading desiccation of the resin constituent which filled up thermosetting resin with the high temperature conductivity filler is carried out at a film base material, and the proposal which carries out the molding unification of the sheet-ized heat dissipation nature sheet and the leadframe is also made (JP,10-173097,A). However, in fabricating this heat dissipation nature sheet, it was what a solvent will not volatilize only from one side of a sheet at the time of desiccation of the resin constituent applied in the shape of a sheet, a solvent tends to remain in the insulating resin layer which carried out hardening shaping of the heat dissipation nature sheet, and a problem tends to generate in insulating dependability. Moreover, although it is common to carry out spreading desiccation of the resin constituent on carrier films, such as a PET film, and to form B stage in case a heat dissipation nature sheet is fabricated It is what a carrier film is not used for production of the circuit board, but requires the part manufacturing cost. Moreover, in order to give the mold-release characteristic of a carrier film and a heat dissipation nature sheet, release agents, such as silicon, are needed. It was the time-consuming thing which silicon is imprinted by the resin front face in the case of the exfoliation from a carrier film, and may start an adhesive agent, and exfoliates a heat dissipation nature sheet from a carrier film on the occasion of use.
[0010] Moreover, also when it was going to improve the heat dissipation nature of exoergic components using the above-mentioned heat dissipation nature sheet, there was same problem.
[0011] This invention is made in view of the above-mentioned point, and it high-fills up with an inorganic filler. It is formed using the thermally conductive resin constituent which can obtain the moldings excellent in thermal conductivity, and this thermally conductive resin constituent. By using for the prepreg which can obtain the moldings excellent in thermal conductivity, and formation of this prepreg of an insulating layer Can form easily the insulating layer which has the outstanding thermal conductivity, and low-cost-izing is possible. And by attaching a metal radiator through the heat dissipation nature circuit board with easy high-current-izing, and the glue line in which it is formed in the above-mentioned prepreg, while the outstanding heat dissipation nature is given The glue line which has the outstanding thermal conductivity can be formed easily, and low-cost-izing is possible and it aims at the outstanding heat dissipation nature offering grant **** heat dissipation nature exoergic components.
[0012]
[Means for Solving the Problem] The thermally conductive resin constituent concerning claim 1 of this invention is characterized by for the particle whose particles whose particles whose mean particle diameter is 50-100 micrometers are 30 - 60 mass section, and whose mean particle diameter is 5-30 micrometers are 30 - 60 mass section and the mean particle diameter of 0.1-3 micrometers blending 5 - 15 mass **** rare ****** filler 80 to 95% of the weight, and changing considering the thermal conductivity of a hardened material as 3 - 10 W/mK.
[0013] Moreover, invention concerning claim 2 is characterized by containing a reactant with the phenol system compound which has two or more phenolic hydroxyl groups in 1 intramolecular shown in the epoxy resin which has two or more epoxy groups in 1 intramolecular, the phenol system resin which has two or more phenolic hydroxyl groups in 1 intramolecular as a curing agent, the phosphine system compound shown in the following type (1) as a hardening accelerator, and the following formula (2) in addition to the configuration of claim 1.
[0014]
[Formula 2]



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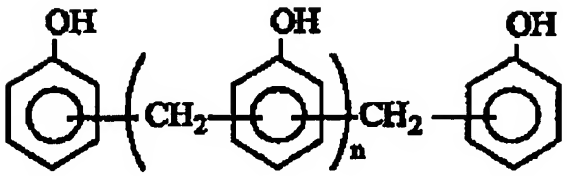

… (2)

(但し、nは0以上の整数)

[0015] Moreover, invention concerning claim 3 is characterized by changing as an inorganic filler using aluminum 2O3, a kind chosen from MgO, BN, AlN, and SiO2, or two sorts or more of things in addition to claim 1 or the configuration of 2.
[0016] Prepreg 1 concerning claim 4 of this invention is characterized by sinking in, drying the resin varnish which blends a solvent with a thermally conductive resin constituent according to claim 1 to 3, and is obtained to the nonwoven fabric of 20-200g/m2 which consists of 10-25mm inorganic fiber ingredients in the fiber diameter of 6-20 micrometers, and fiber length, and growing into it as a semi-hardening condition.
[0017] The heat dissipation nature circuit board 10 concerning claim 5 of this invention is characterized by for a part of at least one leadframe 2 projecting outside from the insulating layer 6 fabricated by prepreg 1, or being exposed, and changing while it carries out the shaping unification of the prepreg 1 according to claim 4 and at least one leadframe 2.
[0018] Moreover, invention concerning claim 6 is characterized by for a part of at least one leadframe 2 projecting outside from the insulating layer 6 fabricated by prepreg 1, or being exposed, and changing while it carries out the shaping unification of the metal radiator 4, the prepreg 1 according to claim 4, and at least one leadframe 2 in addition to a configuration according to claim 5.
[0019] Moreover, in addition to the configuration of claim 6, invention concerning claim 7 is characterized by changing using that by which the radiation fin 5 was formed in one as a metal radiator 4.
[0020] Moreover, invention concerning claim 8 is characterized by in addition to the configuration of claim 5 thru/or either of 7, forming a leadframe 2 with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, and changing.
[0021] Moreover, invention concerning claim 9 is characterized by in addition to claim 6 or the configuration of 7, forming the metal radiator 4 with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, and changing.
[0022] Moreover, invention concerning claim 10 is characterized by carrying out the shaping unification of a leadframe 2 and the prepreg 1 according to claim 4, and changing at the time of shaping, where an enveloping layer is formed in the front face of the circuit 7 exposed to the front face of an insulating layer 6 while it is formed in a leadframe 2 in addition to the configuration of claim 5 thru/or either of 9.
[0023] Moreover, invention concerning claim 11 is characterized by in addition to the configuration of

claim 5 thru/or either of 9, forming two or more weld flash with a height of 0.1-2mm in the periphery of the circuit 7 exposed to the front face of an insulating layer 6, and changing at the time of shaping formed in the leadframe 2.
[0024] Moreover, the heat dissipation nature exoergic components 9 concerning claim 12 of this invention are characterized by carrying out the laminating unification of exoergic components 9a, the prepreg 1 according to claim 4, and the metal radiator 4 at order, and changing.
[0025] moreover, invention concerning claim 13 -- the configuration of claim 12 -- in addition, as a metal radiator 4, the radiation fin 5 was formed in one and characterized by using and changing.
[0026] Moreover, invention concerning claim 14 is characterized by in addition to claim 12 or the configuration of 13, forming the metal radiator 4 with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, and changing.
[0027]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained.
[0028] Thermosetting resin, such as an epoxy resin, phenol resin, cyanate resin, polyimide resin, and heat-curing mold polyphenylene oxide resin (PPO resin), can be blended, and it is independent about these, or two or more sorts can be suitably used together in a thermally conductive resin constituent, and can be used for it. Using what was brominated, and the thing by which Lynn conversion was carried out as these thermosetting resin can give fire retardancy, and it is desirable. When a flame retarder is added separately, without using the resin by which flameproofing was carried out here, there is a possibility that thermal resistance and a mechanical strength may fall. As for the loadings of thermosetting resin, it is desirable to consider as five to 20 mass %.
[0029] Although it will not be limited especially if it has two or more epoxy groups in a monad at least when using an epoxy resin as thermosetting resin, the novolak mold epoxy resin represented by o-cresol novolak mold epoxy resin, for example, a dicyclopentadiene mold epoxy resin, the biphenyl mold epoxy resin of two organic functions, a bisphenol mold epoxy resin, a naphthalene mold epoxy resin, the triphenylmethane color mold epoxy resin of three organic functions, etc. are mentioned. These may be used independently or two or more kinds may be used together.
[0030] As a curing agent of an epoxy resin, the phenol system resin which has two or more phenolic hydroxyl groups in a monad at least, such as bisphenols, such as phenol novolak resin, phenol aralkyl resin, a cyclopentadiene, a phenol polymer, naphthalene mold phenol resin, bisphenol A, and Bisphenol F, is mentioned, for example. Moreover, amine system curing agents, such as a dicyandiamide, and diamino diphenylmethane, triethylenetetramine, a BF3-monoethyl amine, imidazole derivatives, an acid-anhydride system curing agent, etc. can also be used. These curing agents may be used independently or may use two or more kinds together. The loadings of the total amount of a curing agent are usually blended in 0.3-1.5 by equivalent ratio to epoxy thermosetting resin.
[0031] Moreover, the hardening accelerator generally used can be used as a hardening accelerator, for example, they are 1 and 8 diazabicyclo (5, 4, 0)-undecene. - Organic phosphines, such as imidazole derivatives, such as ring type amines, such as the 7, 1, and 5-diazabicyclo (4, 3, 0)-nonene -5, 2-methylimidazole, 2-phenylimidazole, and 2-ethyl-4-methylimidazole, and triphenyl phosphine, are mentioned. As for the loadings of a hardening accelerator, it is desirable to consider as the range of 0.01 - 1 mass %.
[0032] Moreover, the reactant to which the tetra-phenyl HOSUFONIUMU tetraphenyl borate (it is hereafter called TPPK for short) which is the phosphine system compound shown by the above-mentioned formula (1) as a hardening accelerator was made to react with the phenoxy compound (for phenol resin to also be included) which has two or more phenolic hydroxyl groups in a monad at least can also be used. As a phenolic compound for hardening accelerators, 3 organic-functions phenols, such as bisphenols, such as bisphenol A, Bisphenol F, and Bisphenol E, and Tori (4-hydroxyphenyl) methane, a phenol novolak compound (phenol novolak resin), etc. are mentioned.
[0033] The phenol novolak compound (phenol novolak resin) shown in the above-mentioned formula

(2) also in these is desirable, and especially the phenol novolak compound whose softening temperature is 80 degrees C or less and whose content of the thing (n= 2 or more things) of four or more nuclides the content of three nuclides (thing of n= 1) is below 40 mass % above 45 mass % is still more desirable. If the phenol novolak compound with which softening temperature exceeds 80 degrees C, or the phenol novolak compound with which the phenol novolak compound of under 45 mass % or n= 2 or more things exceed [the thing of n= 1] 40 mass % is used, the softening temperature of a reactant (hardening accelerator) with TPPK becomes high, and it is further hard coming to dissolve it in solvents, such as an acetone and a methyl ethyl ketone, and it is not practical. In addition, although especially a minimum is not set up since the softening temperature of the phenol novolak compound of this invention is so desirable that it is low, as an available thing, softening temperature is 50 degrees C. Moreover, although especially an upper limit is not set up since it is so desirable that there is much three nuclide in the phenol novolak compound of this invention, as an available thing, three nuclides are as follows [100 mass %]. Furthermore, since it is so desirable that there is little four nuclide in the phenol novolak compound of this invention, especially a minimum is not set up.

[0034] It agitates for 1 to 5 hours, and is made to make a phenolic compound and TPPK react, if in charge of generating the above-mentioned hardening accelerator, mixing TPPK for TPPK at a rate of 5 - 40 mass section to the phenolic compound 100 mass section preferably below 50 mass sections, and heating a phenolic compound and TPPK in 160-200 degrees C within a reaction container to the phenolic compound 100 mass section. Although the terminal point of a reaction is cloudy, without TPPK dissolving in melting resin (phenolic compound) in the early stages of churning, it becomes transparence with the almost uniform whole between churning of 1 - 5 hours. This time can judge it as a reaction terminal point. The masterbatch (mixture) of a solid hardening accelerator can be formed by taking out uniform resin melt from a reaction container, and cooling after reaction termination. And it enables the resin constituent and prepreg 1 after desiccation to become that in which B stage-ization will not progress to rapidly and the resin constituent and prepreg 1 after desiccation have flexibility, even if it is the process which dries a resin constituent and the organic solvent in production of prepreg 1 and drying temperature is 60-90 degrees C, and to harden for a short time, if this reactant is used for a curing catalyst (hardening accelerator) with the curing agent which are an epoxy resin and phenol system resin.

[0035] Productivity (reactivity) becomes it scarce that TPPK is under 5 mass sections to the phenolic compound 100 mass section, and when using curing agents other than phenol system resin as a curing agent, there is a possibility that phenol system resin may be mixed beyond the need. On the other hand, when TPPK exceeds 40 mass sections to the phenol novolak compound 100 mass section, there is a possibility that it may become difficult for the softening temperature of a reactant to go up sharply, and for melt viscosity to go up to coincidence, and to mix to other components and homogeneity in the kneading actuation at the time of preparation of a resin constituent.

[0036] It is desirable to use aluminum 2O3 and at least one kind of thing chosen from MgO, BN, AlN, and SiO2 as an inorganic filler. Since these inorganic fillers are excellent in thermal conductivity and a degree of freedom is in particle size distribution further, the grain-size design for forming high restoration is easy for them.

[0037] In this invention, a thing with a mean particle diameter of 50-100 micrometers as such an inorganic filler Moreover, 30 - 60 mass section, That whose things with a mean particle diameter of 5-30 micrometers are 30 - 60 mass section and the mean particle diameter of 0.1-3 micrometers uses what is contained at a rate of 5 - 15 mass section, and the blending ratio of coal of the inorganic filler in a thermally conductive resin constituent is made into 80 to 95 mass %. It is made for the thermal conductivity of the hardened material of a thermally conductive resin constituent to serve as 3 - 10 W/mK. That is, high thermal conductivity called 3 - 10 W/mK is given to the hardened material of a thermally conductive resin constituent by using the inorganic filler of the above particle size by combining an inorganic filler at a rate of 80 - 95 mass % into a thermally conductive resin constituent, and making it high-filled up with an inorganic filler in this way.

[0038] Moreover, it is desirable to perform surface treatment to the above-mentioned inorganic filler in silane coupling agents, such as gamma-glycidoxypropyltrimetoxysilane, or to add a dispersant etc., and

to raise the dispersibility to the inside of a resin constituent.
[0039] A slurry-like resin varnish can be obtained by making a solvent distribute the thermally conductive resin constituent which consists of each above component. A resin varnish can blend each above-mentioned component and an above-mentioned solvent, and can prepare them by mixing at a room temperature with kneading machines, such as a planetary mixer.
[0040] Here, it is especially desirable for a solvent to be a low boiler, and the shape of surface type of the prepreg 1 fabricated in a resin varnish becomes good by using it as a partially aromatic solvent. Especially as such a solvent, it is desirable to use a methyl ethyl ketone, an acetone, etc. On the other hand, possibility of a high boiler of not volatilizing enough but remaining at the time of desiccation is high, and it has a possibility of reducing the electric insulation and the mechanical strength of a hardened material. Such a solvent is for giving a fluidity for a resin constituent becoming that it is easy to sink into a nonwoven fabric, and, as for the loadings, it is desirable to consider as the range where the viscosity of the resin varnish prepared serves as 500-5000cP.
[0041] Moreover, the mass per unit area which consists of an inorganic fiber whose fiber diameter is 6-20 micrometers, and whose fiber length is 10-25 micrometers as a nonwoven fabric uses the nonwoven fabric of 20 - 200 g/m2. As an inorganic fiber which constitutes such a nonwoven fabric, inorganic fibers, such as glass, an alumina, and boron nitride, can be used, and the thermal conductivity of the insulating layer 6 fabricated from prepreg 1 can be improved by using an inorganic fiber in this way.
[0042] In producing prepreg 1, a resin varnish is infiltrated into a nonwoven fabric, for example, at 100-150 degrees C, stoving can be carried out for 5 - 30 minutes, and semi-hardening can be carried out. Although especially limitation is not carried out, as for the thickness of prepreg 1, it is desirable to be referred to as 0.1-5mm. Thus, the prepreg 1 obtained is the sheet-like molding material with which it was strengthened with the nonwoven fabric and handling nature became good, and can fabricate the moldings of a thin film large area easily by using this prepreg 1. Moreover, while high-filling up with an inorganic filler into this prepreg 1, in order for homogeneity to distribute and to fabricate the shaping hardened material of high temperature conductivity, it is used suitably.
[0043] If the fiber diameter of the fiber which constitutes a nonwoven fabric exceeds 20 micrometers in producing prepreg 1 here, while the restoration nature of the inorganic filler in a resin varnish is spoiled, or a filler stops being able to enter easily and high-filling up with an inorganic filler between fiber, it will become difficult to obtain the prepreg 1 distributed to homogeneity. Conversely, if this fiber diameter does not fulfill 6 micrometers, the tensile strength of a nonwoven fabric falls, there is a possibility that fiber may go out in processes, such as sinking [of a resin varnish] in, and there is a possibility that the chewiness of the prepreg 1 fabricated may become weak and handling nature may fall. Although it is possible to use a binder so much here in order to cancel such a fault, the thermal conductivity of a shaping hardened material is made to fall, and it is not desirable.
[0044] Moreover, if the fiber length of the fiber which constitutes a nonwoven fabric exceeds 25mm, while the restoration nature of the inorganic filler in a resin varnish is spoiled, or a filler stops being able to enter easily and high-filling up with an inorganic filler between fiber, it will become difficult to obtain the prepreg 1 distributed to homogeneity. Moreover, in case the reinforcement of prepreg 1 becomes high too much and fabricates a hardening moldings, there is a possibility that it may be hard coming to distribute fiber and the roughness and fineness of a fiber consistency may occur in a hardening moldings. Conversely, if this fiber length does not fulfill 10mm, the tensile strength of a nonwoven fabric falls, there is a possibility that fiber may go out in processes, such as sinking [of a resin varnish] in, and there is a possibility that the chewiness of the prepreg 1 fabricated may become weak and handling nature may fall.
[0045] Furthermore, if the mass per unit area of a nonwoven fabric does not fulfill 20 g/m2, the tensile strength of a nonwoven fabric falls, there is a possibility that fiber may go out in processes, such as sinking [of a resin varnish] in, and there is a possibility that the chewiness of the prepreg 1 fabricated may become weak and handling nature may fall. Moreover, when a resin varnish will be enough infiltrated into a nonwoven fabric if the mass per this unit area exceeds 200 g/m2, and it is going to make it a resin front face and a fiber front face become flat-tapped, in case thickness is set to about

1.5mm, and it becomes difficult to make it fully dry to the interior at the time of desiccation and it is bent with a conveyance roll in a conveyance process, there is a possibility that a crack may occur. if the amount of resin sinking in is lessened here in order to prevent such a situation -- a front face -- fiber -- a rich layer will be formed and there is a possibility that the adhesion stability at the time of shaping may be spoiled.

[0046] As a leadframe 2, in order to improve adhesion with insulating-layer 6 grade to both sides, it can pierce to the metal plate which performed the surface roughening process, cutting processing of processing etc. can be performed, a circuit 7 can be formed, and what performed plating processing of nickel plating for improving soldering nature and wire-bonding nature on the front face if needed further etc. can be used.

[0047] This leadframe 2 can consist of the lead section 11, a circuit 7, and a frame part 12 surrounding the perimeter of the field in which this circuit 7 and the lead section 11 are formed. This circuit 7 consists of residual parts of the metal formed by piercing to a metal plate and performing processing etc. It connects partially [a circuit 7 and a frame part 12] in the lead section 11 which consists of metaled residual parts, and the circuit 7 is supported by the frame part 12 through this lead section 11 here. Although only the one lead section 11 may be connected and two or more may connect like illustration to one circuit 7, this lead section 11 As mentioned later, it is that from which the part constitutes the terminal electrode 3 of the heat dissipation nature circuit board 10. Since the lead section 11 which is not used as a terminal electrode 3 needs to perform insulating processing, in order to make it not apply such time and effort, it is desirable to connect only the one lead section 11 to one circuit 7. Moreover, the lead section 11 which is not connected to a circuit 7 may be formed.

[0048] A leadframe 2 can improve heat dissipation effectiveness while it is desirable to form from at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, it is hard coming to generate curvature etc. in the heat dissipation nature circuit board 10 and it improves reinforcement. Especially when thinking the electrical conductivity as a circuit 7 as important, it is desirable to form with copper system ingredients, such as copper and an alloy containing copper. Moreover, it is desirable to use iron, if priority is given to reinforcement for aluminum when attaining low-cost-izing and lightweight-ization.

[0049] Moreover, while it is desirable to consider as the range of 0.2mm - 3mm as for the thickness of a leadframe 2 and being able to pass a high current to a leadframe 2 in this case, the function as a primary heat spreading device of the exoergic components 9 (power components) mounted in the heat dissipation nature circuit board 10 can be made to have. That is, when thickness is formed in this range, while making sufficient current capacity for passing a high current in the circuit 7 of the heat dissipation nature circuit board 10 formed from a leadframe 2 hold, the heat capacity of this circuit 7 is improved, generation of heat from exoergic components, such as the power IC mounted in the heat dissipation nature circuit board 10, can be absorbed in a circuit 7, and heat dissipation effectiveness can be improved.

[0050] Bending processing, spinning, etc. are performed and solid shaping of this leadframe 2 is carried out so that some or all of a circuit 7 that was fabricated may project towards the one side side of a leadframe 2, or both-sides side.

[0051] In the example shown in drawing 1 , while forming two or more circuits 7 in a leadframe 2 Among these, per [which is connected to two circuits 7a and 7a and these circuits 7a and 7a, respectively / lead section 11a], It bends and the middle of each lead section 11a is fabricated so that circuit 7a may project in the whole surface side of a leadframe 2, further, it bends and the boundary of lead section 11a and circuit 7a is fabricated so that circuit 7a may be arranged at a leadframe 2 and abbreviation parallel. At this time, it forms so that two circuits 7a and 7a fabricated so that it might project in the whole surface side of a leadframe 2 may be arranged on an abbreviation same flat surface. On the other hand, a remaining circuit 7 (circuits 7b and 7c) and the remaining lead section 11 (lead sections 11b and 11c) are arranged flat-tapped on the same field as a frame part 12. the circuits 7b and 7c arranged flat-tapped with the field by the side of the field of the outside of a circuit 7, i.e., the whole

surface of circuit 7a formed so that it might project in a whole surface side, and a frame part 12 -- on the other hand, a near field is hereafter called exposure 19.
[0052] On the other hand, as a molding die 13, what consists of molds 13a and 13b of a pair is used. Hollows 14a and 14b are formed in each molds 13a and 13b, respectively, and a cavity consists of space surrounded by Hollows 14a and 14b by carrying out mold doubling of the molds 13a and 13b of a pair so that this hollow 14a and 14b may counter.
[0053] Here, one hollow 14a is formed so that the inside may be arranged along with the exposure 19 of circuit 7a at the time of mold doubling, while being formed in the configuration in which circuit 7a which projects from the frame part 12 of a leadframe 2 is settled. Moreover, from this hollow 14, the lobe 18 which projects towards one or more (illustration two pieces) circuit 7b in the circuits 7b and 7c flat-tapped with a frame part 12 is formed. The end face of this lobe 18 is formed so that that end face may be arranged along the front face of circuit 7b at the time of mold doubling.
[0054] Moreover, the lobe 26 is formed in the field corresponding to the frame 12 side between the lead sections 11 by which the terminal electrode 3 is formed in one mold 13a. This lobe 26 is formed so that that end face may contact mold 13b of another side, while it is arranged between the lead sections 11 which adjoin each other at the time of mold doubling, filled the clearance between the adjacent lead sections 11, and has prevented the outflow of resin.
[0055] Moreover, hollow 14b of another side is formed in the configuration in which a frame 12 is settled. Moreover, in fabricating the heat dissipation nature circuit board 10, the prepreg 1 of one sheet or two or more sheets (illustration two sheets) is arranged to the whole surface side which is a field of the side which circuit 7a of the leadframe 2 by which solid shaping was carried out has projected, the molds 13a and 13b of a pair are arranged so that a leadframe 2 and prepreg 1 may be inserted further, and mold doubling of the molds 13a and 13b is carried out. While opening 15 is formed also in the part corresponding to the lobe 18 of mold 13a while forming opening 15 in the part corresponding to the formation location of circuit 7a which projects from a frame 12 in prepreg 1, and making it prepreg 1 not intervene between circuit 7a and the inside of a cavity, he is trying for prepreg 1 not to intervene here between the end face of a lobe 18, and the corresponding front face of circuit 7b.
[0056] Although illustration is not carried out at this time, the enveloping layer which has thermal resistance and a mold-release characteristic beforehand can be prepared in the exposure 19 of a circuit 7. In this case, as for the thickness of an enveloping layer, it is desirable to be referred to as 10 micrometers or more. This enveloping layer can be formed in products made from a resin film, such as a product made from polyethylene terephthalate, and a product made from polyphenylene sulfide, and pastes up a resin film on the exposure 19 of a circuit 7 in this case. Moreover, an enveloping layer can also be formed in the paint film of a liquefied resist, and can use the liquefied resist of a resin system in this case, and that paint film is [a removable thing] easily desirable using an alkali solution etc. The photopolymer constituent which consists of a photopolymer constituent which consists of unsaturated polyester, a proper partial saturation monomer, a photopolymerization object, etc., urethane (meta) acrylate oligomer, water-soluble cellulosic resin, a photopolymerization initiator, an acrylate (meta) monomer, etc. as such a liquefied resist, for example can be used. Thus, when using a photopolymer constituent as a liquefied resist, after applying a liquefied resist to the front face of a leadframe 2, by carrying out exposure hardening, an enveloping layer can be formed and alkali solutions, such as a sodium-hydroxide solution, can remove this enveloping layer easily.
[0057] Thus, preheating of the 100-300 degrees C is preferably carried out for several minutes at 150-200 degrees C with the pressure of 5-200kg/cm2 (0.49-19.6MPa) according to the condition of having arranged a molding die 13, prepreg 1, and a leadframe 2. At this time, while remelting and flowing in accordance with the interior configuration of cavity 14, a leadframe 2 is buried without a clearance, a hardening reaction advances further, an insulating layer 6 is formed, and this insulating layer 6 fixes completely the thermally conductive resin constituent which constitutes prepreg 1 to a leadframe 2. Here, if detailed irregularity is beforehand formed in the part covered by the insulating layer 6 of the front face of a leadframe 2 or the oxide film is formed, adhesion with an insulating layer 6 will improve.
[0058] In such a forming process, according to a flow of a thermally conductive resin constituent, it will

be cut easily, a flow of resin will not be barred, the fiber cut at this time will be distributed by homogeneity in an insulating layer 6, and the mechanical strength of fiber of the nonwoven fabric which constitutes prepreg 1 of the insulating layer 6 fabricated by prepreg 1 will improve. Moreover, since prepreg 1 is not arranged between the exposure 19 of the circuit 7 before shaping, and the inside of the hollows 14a and 14b which constitute a cavity but the exposure 19 of a circuit 7 is further arranged in accordance with the inside of Hollows 14a and 14b in a forming process, it will expose outside, without covering this exposure 19 by resin. Moreover, the end face of a lobe 18 will be arranged along the front face of circuit 7b corresponding to a lobe 18 at this time, and the contact side 22 with the end face of the lobe 18 in this circuit 7c will be exposed outside, without being covered by resin.

[0059] moreover, when the enveloping layer is prepared in the exposure 19 By this resin's adhering on the surface of an enveloping layer, even if resin flows to an exposure 19, and removing this enveloping layer after shaping The affix of the resin hardened material with which the resin of prepreg 1 which resin does not adhere to the exposure 19 of a circuit 7, and was fused in the heating pressurization process hardens, and is formed in the condition of turning to the enveloping layer In case an enveloping layer is removed, it can remove together, and adhesion of the affix of the resin hardened material in a circuit 7 can be prevented, and circuit formation precision can be improved. Therefore, the solder wettability in the case of mounting electronic parts in the heat dissipation nature circuit board 10 can be improved, and connection dependability can be improved.

[0060] And after-cure is performed and it is made to harden completely after shaping by heating at 175 degrees C for several hours further, for example. As for this heating pressing, it is desirable to carry out under the reduced pressure ambient atmosphere near a vacuum, it can prevent air collecting in a cavity 14 in this case, and mixing of a void can be controlled and the dependability of the heat dissipation nature circuit board 10 fabricated can be improved.

[0061] Thus, the heat dissipation nature circuit board 10 fabricated serves as a configuration which the exposure 19 of circuit 7a exposed to the whole surface of the insulating layer 6 from which the fiber which constituted the nonwoven fabric distributed, and which it consisted of in the hardened material of a thermosetting resin constituent. Moreover, the crevice 21 is formed in the part corresponding to the lobe 18 of an insulating layer 6, and the contact side 22 of circuit 7b corresponding to a lobe 18 will be exposed to the base of this crevice 21. moreover, although the exposure 19 of circuit 7b and illustration have not been carried out, on the other hand, an insulating layer 6 will boil the exposure 19 of circuit 7c, it will expose, and the circuit 7 of a bilayer is formed in one leadframe.

[0062] Moreover, from the flank of an insulating layer 6, it is arranged so that the frame part 12 which the part by the side of the frame part 12 of the lead section 11 has projected, and was connected to this lead section 11 may surround the perimeter of an insulating layer 6. This frame part 12 is cut and removed on a boundary with the lead section 11, and a part of lead section 11 which projects from an insulating layer 6 on the other hand while remaining in the heat dissipation nature circuit board 10 side is formed as a terminal electrode 3. Furthermore, if needed, the exposure 19 of a circuit 7 is made to carry out printing hardening of the solder resist, it forms in it, and electronic parts are mounted in it by solder connection etc.

[0063] Thus, if the heat dissipation nature circuit board 10 is obtained, it can excel in a mechanical strength, and the coefficient of thermal expansion can become in degree C and 20 ppm /or less, and, as for thermal conductivity, the insulating layer 6 fabricated by the prepreg 1 made to high-fill up with an inorganic filler as mentioned above can obtain 3 or more W/mK. This can be said to be the hardened material which cannot carry out heat deformation easily while it is very excellent in the so-called alpha matching nature with electronic parts with a semiconductor chip. That is, the difference of the coefficient of thermal expansion alpha of the silicon chip of electronic parts and the coefficient of thermal expansion of an insulating layer 6 which are mounted in the heat dissipation nature circuit board 10 can become small, are recording of the internal stress by the heat history by passing through a soldering process etc. can be controlled, and generating of a crack can be prevented.

[0064] Moreover, if an insulating layer 6 is formed with metal mold shaping of prepreg 1 as mentioned above, since the carrier film is not prepared in one side like [in the case of carrying out spreading

desiccation of the resin constituent, and forming a heat dissipation nature sheet in a resin film etc.] By the solvent volatilization from both sides being possible, desiccation speed being quick at the time of formation of prepreg 1, and uniform desiccation hardening being possible to it, and using a nonwoven fabric base material for it While forming in the shape of a sheet, it can form in the sticky quality of the material, and handling nature becomes very good, and it is hard to generate a chip etc. at the time of processing of cutting etc. Moreover, since there is no carrier film, it is easy to carry out processing of cutting etc. Furthermore, only a part with a carrier film unnecessary also in cost can reduce a manufacturing cost, and can reduce the manufacturing cost especially in the desiccation conversion cost of resin. Moreover, although silicon etc. is generally used for mold-release characteristic grant with a heat dissipation nature sheet and a carrier film when using a carrier film, such a release agent also becomes unnecessary. Furthermore, it can also be prevented possibility that silicon will imprint on a resin front face and poor adhesion will occur arising. Moreover, although a heat dissipation nature sheet must be exfoliated from a carrier film at the time of shaping of the heat dissipation nature circuit board 10, if prepreg 1 is used, it will not take such time and effort.

[0065] Moreover, in case in forming the heat dissipation nature circuit board 10 as mentioned above a leadframe 2 is pierced and it fabricates by processing, without preparing an enveloping layer in the front face of a circuit 7, it is also desirable by piercing with the profile of a circuit 7 and carrying out [form / between metal mold / path clearance (clearance)] to form two or more weld flash 8 with a height of 0.1-2mm throughout the periphery of a circuit 7, so that it may project in an exposure 19 side. And at the time of the heating pressing of the heat dissipation nature circuit board 10, when this weld flash 8 is pressed by the inside of the hollow 14 of form 12a, weir 8a surrounding the perimeter of a circuit is formed in the boundary of the front face of a circuit 7, and the front face of an insulating layer 6. Therefore, by this weir 8a, turning of the resin of prepreg 1 fused in the heating pressurization process to **** stop **** and circuit 7 front face can be lost, it can prevent adhesion of the affix of the resin hardened material in a circuit 7, and can improve circuit formation precision. Therefore, the solder wettability in the case of mounting electronic parts in the heat dissipation nature circuit board 10 can be improved, and connection dependability can be improved.

[0066] The one heat dissipation nature circuit board 10 is fabricated in drawing 3 and the example shown in 4 using two leadframes 2. Here, two or more leadframes 2 may use. The leadframe 2 (leadframe 2a) forms two circuits 7 (circuits 7d and 7d) in the frame 12 interior, and while it is shown in drawing 3 has connected the lead section 11 (lead sections 11d and 11d) to 7d of each circuit, respectively. 7d of this circuit is formed so that 11d of lead sections may be bent like lead section 11a in drawing 1 and it may project towards the one side side of a frame 12 processing or by carrying out spinning. Moreover, in the leadframe 2 (leadframe 2b) of another side, two or more lead sections 11 (lead section 11e) and circuits 7 (circuit 7e) are formed flat-tapped with a frame 12. Here, circuit 7e and lead section 11e are formed in the location corresponding to 7d of circuits of one leadframe 1a in leadframe 2b of another side.

[0067] In fabricating the heat dissipation nature circuit board 10, each part material is arranged in order of the metal radiators 4 and 1 or the prepreg 1 of two or more sheets (illustration two sheets), leadframes 2a and 1 or the prepreg 1 of two or more sheets (illustration one sheet), and leadframe 2a. At this time, opposite arrangement of leadframe 2a and the 2b is carried out so that solid shaping of while might be carried out and the circuits 7d and 7e which project from the frame 12 of leadframe 2a may be arranged at the leadframe 2b side of another side. He forms opening 15 in the part corresponding to the formation location of the circuits 7d and 7e which project from the frame 12 of leadframe 2a in the prepreg 1 arranged between two 2bs, leadframe 2a and 2b, and is trying for prepreg 1 not to intervene between 7d of circuits, and the inside of a cavity 14 here.

[0068] Moreover, at this time, a spacer 23 is made to intervene between frame 14 comrades, two 2bs, leadframe 2a and 2b, a clearance is maintained between leadframe 2a and 2bs, and the electric insulation between leadframe 2a and 2b is secured. Here, the thickness of a spacer 23 presupposes that it is the same as that of the frame 14 of one leadframe 2a, and the dimension of the clearance between 7d of circuits, and it is arranged flat-tapped with this leadframe 2b while 7d of circuits is arranged inside the

frame 12 of leadframe 2b, when leadframe 2a and 2bs are piled up through a spacer 23.
[0069] And metal mold shaping is carried out using the shaping metal mold 13 which consists of forms 13a and 13b of a pair on the same conditions as the case where leadframe 2a of one [these metal radiators 4, prepreg 1, and] leadframe 2a, prepreg 1, and another side is shown in drawing 1 .
[0070] Here, hollow 14of mold 13a arranged at leadframe 2b side a is formed so that the inside may be arranged along the front face of circuit 7 leadframe 2b at the time of mold doubling.
[0071] Moreover, hollow 14b of another side consists of a shallow crevice 24 by which leadframe 2a is arranged at the time of mold doubling, and a deep crevice 25 which carries out opening to the base of this shallow crevice 24 and by which the metal radiator 4 and prepreg 1 are arranged at the time of mold doubling. This deep crevice 25 is formed inside periphery section 24a by which the edge by the side of the frame part 12 of the frame part 12 and lead section 11e which were formed in the periphery of a shallow crevice is arranged.
[0072] Moreover, the lobe 26 is formed in the field corresponding to the frame 12 side between the lead sections 11 by which the terminal electrode 3 is formed in each molds 13a and 13b. This lobe 26 is formed so that it may be arranged between the lead sections 11 which adjoin each other at the time of mold doubling, filled the clearance between the ****** lead sections 11, and has prevented the outflow of resin.
[0073] In such a forming process, according to a flow of a thermally conductive resin constituent, it will be cut easily, a flow of resin will not be barred, the fiber cut at this time will be distributed by homogeneity in an insulating layer 6, and the mechanical strength of fiber of the nonwoven fabric which constitutes prepreg 1 of the insulating layer 6 fabricated by prepreg 1 will improve. Moreover, prepreg 1 is not arranged between the exposure 19 of the circuit 7 before shaping, and the inside of the hollows 14a and 14b which constitute a cavity 14, but it will expose outside further, without arranging the exposure 19 of a circuit 7 in accordance with the inside of Hollows 14a and 14b, and covering this exposure 19 by resin in a forming process.
[0074] Here, adhesion of the affix of the resin hardened material to the exposure 19 of a circuit 7 can be prevented by preparing an enveloping layer in the exposure 19 of a circuit 7 like the case of drawing 1 , or forming weld flash 8 in a circuit 7.
[0075] Thus, as the formed circuit board 10 is shown in drawing 4 R> 4, although 7d of circuits currently formed in the whole surface side of an insulating layer 6 at leadframe 2a and illustration have not been carried out, the exposure 19 of circuit 7e currently formed in leadframe 2b will be exposed, and a three-dimensional circuit pattern is formed in the interior. Thus, by being formed using two or more leadframes 2 formed in three dimensions, a circuit 7 can be formed by the more complicated and high consistency compared with the case where only one sheet does not use a leadframe 2.
[0076] Moreover, from the flank of an insulating layer 6, it is arranged so that the frame part 12 which the part by the side of the frame part 12 of the lead section 11 has projected, and was connected to this lead section 11 may surround the perimeter of an insulating layer 6. It cuts and this frame part 12 is removed on a boundary with the lead section 11, as shown in drawing 4 (b), and a part of lead section 11 which projects from an insulating layer 6 on the other hand while remaining in the heat dissipation nature circuit board 10 side is formed as a terminal electrode 3. Furthermore, if needed, the exposure 19 of a circuit 7 is made to carry out printing hardening of the solder resist, it forms in it, and electronic parts are mounted in it by solder connection etc.
[0077] Here, when shown in drawing 3 and 4, an enveloping layer may be formed in the exposure 19 of a circuit 7 at the time of shaping, and two or more weld flash 8 may be formed in a circuit 7.
[0078] In the example shown in drawing 5 , the two lead sections 11 (lead sections 11f and 11g) are formed in the 1 side of a leadframe 2 from the frame part 12, and the circuit 7 (circuits 7f and 7g) is formed in each. Among these, 11f of one lead sections is bent so that 7f of circuits may project towards a whole surface side from a frame part 12, processing or spinning is performed to them, such [11g of lead sections of another side] processing is not performed, but 7g of circuits serves as a frame part 12 and abbreviation flush. Moreover, the one lead section 11 (11h of lead sections) is formed in the side besides a leadframe 2 from the frame part 12, and the circuit 7 (7h of circuits) is connected to 11h of this

lead section. Here, it is bent and fabricated by the abbreviation perpendicular, the standing-up section 16 is formed, the part by the side of the frame part 12 of 11h of lead sections is also bent and processed into a side besides a leadframe 2, and the side besides a leadframe 2 constitutes a part of standing-up section 16. Moreover, in the standing-up section 16 of 11h of lead sections, it bends into the part of the opposite side and processing or spinning is performed, and while 7h of circuits projects in the whole surface side of a leadframe 2, it is arranged so that it may become 7f of circuits, and abbreviation flush.

[0079] Moreover, the metal radiator 4 is used in the example shown in drawing 5 . This metal radiator 4 can improve heat dissipation effectiveness while it is desirable to form with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, it is hard coming to generate curvature etc. in the heat dissipation nature circuit board 10 in this case and it improves reinforcement. It is desirable to use iron, if priority is given to reinforcement for aluminum when attaining low-cost-izing and lightweight-ization here. Although the tabular thing is used as a metal radiator 4 in the example of illustration, if two or more radiation fins are formed in this metal radiator 4 at one, heat dissipation nature can be improved further.

[0080] Moreover, a molding die 13 consists of submold 13c attached to one [the molds 13a and 13b of a pair, and] mold 13a. In hollow 14a of one mold 13a, the insertion crevice 17 of the configuration corresponding to the tip side of the standing-up section 16 of a leadframe 2 is formed. This insertion crevice 17 is formed in a lower part and the side so that opening may be carried out, and opening of the side is blockaded in submold 13c arranged in the side of mold 13a. Moreover, in the opening edge of the lower part of the insertion crevice 17, the lobe 26 is formed in the location corresponding to the field between the lead section 11 in the standing-up section 16, and a frame 12 at submold 13a. At the time of mold doubling, this lobe 26 is formed so that that end face may contact the medial surface of the insertion crevice 17 of mold 13a, while being arranged between the lead section 11 and a frame 12 at the time of mold doubling, and this lobe 25 filled the clearance between the adjacent lead section 11 and a frame 12, and has prevented the outflow of resin. Moreover, the lobe 18 which projects towards a leadframe 2 side is formed in the location which agrees with 7g of circuits which the inside of this hollow 13a is formed in the configuration where the circuits 7f and 7g which project from the frame part 12 of a leadframe 2 were met, and are formed still more nearly flat-tapped with the frame part 12 of a leadframe 2, and the end face of this lobe 18 is formed in the configuration where 7g of circuits was met. Moreover, the lobe 26 is formed in the field equivalent to the frame 12 side between the lead sections 11 by which the terminal electrode 3 is formed in mold 13a except for the standing-up section 16 side. This lobe 26 is formed so that mold 13b of another side may be contacted, while it is arranged between the lead sections 11 which adjoin each other at the time of mold doubling, filled the clearance between the ****** lead sections 11, and has prevented the outflow of resin.

[0081] In fabricating the heat dissipation nature circuit board 10 The metal radiator 4 is arranged to the side which the circuit 7 of the leadframe 2 by which solid shaping was carried out has not projected. Furthermore, the prepreg 1 of one sheet or two or more sheets is made to intervene between a leadframe 2 and the metal radiator 4, while arranging the molds 13a and 13b of a pair on the outside of both sides further, submold 13c is arranged to the side of mold 13a, and mold doubling of the molds 13a and 13b is carried out. All parts are arranged in a cavity 14 and, as for prepreg 1, only the part by the side of the tip of a frame part 12 and the lead section 11 is made not to be arranged in a cavity 14 by designing suitably the dimension and configuration of prepreg 1, a leadframe 2, and a molding die 13 at this time in parts other than standing-up section 16, as for a leadframe 2. At this time, Circuits 7f and 7h are arranged in accordance with the inside of hollow 14a, and 7g of circuits is further arranged along with the end face of a lobe 18. Moreover, the tip of the standing-up section 16 is arranged in the insertion crevice 17, and at this time, while all the parts arranged at the tip side of the standing-up section 16 of a frame part 14 are arranged, the part by the side of the tip of 11h of lead sections is arranged in the insertion crevice 17.

[0082] Thus, heating pressing and after-cure are given on the same conditions as the condition which

has arranged a molding die 13, prepreg 1, the leadframe 2, and the metal radiator 14, and the thing shown in drawing 1 .

[0083] In this forming process, like the case where it is shown in drawing 1 etc., according to a flow of a thermally conductive resin constituent, it will be cut easily, a flow of resin will not be barred, the fiber cut at this time will be distributed by homogeneity in an insulating layer 6, and the mechanical strength of fiber of the nonwoven fabric which constitutes prepreg 1 of the insulating layer 6 fabricated by prepreg 1 will improve. Moreover, in this forming process, when the fused resin flows, it is stuck to the insulating layer 6 and the metal radiator 4 which are formed by prepreg 1 without a clearance, and the metal radiator 4 is attached in one to the heat dissipation nature circuit board 10. Moreover, since prepreg 1 is not arranged between the exposure 19 of the circuit 7 before shaping, and the inside of a cavity 14, it will expose outside, without covering this exposure 19 by resin. It will expose on the top face of an insulating layer 6, and the Circuits [7f and 7g] exposure 19 will expose the exposure 19 of 7h of circuits here in the base of the crevice 21 formed in the location corresponding to the lobe 18 of mold 13a in the top face of an insulating layer.

[0084] From the flank of an insulating layer 6, after shaping is arranged so that the frame part 12 which the part by the side of the frame part 12 of the lead section 11 has projected, and was connected to this lead section 11 may surround the perimeter of an insulating layer 6. This frame part 12 is cut and removed on a boundary with the lead section 11, on the other hand, a part of lead section which projects from an insulating layer 6 while remaining in the heat dissipation nature circuit board 10 side is formed as a terminal electrode 3, and the heat dissipation nature circuit board 10 is obtained. 3g of terminal electrodes which consist of tip sides which are 11g of lead sections although 3f of terminal electrodes and illustration which consist of tip sides of 11f of lead sections are not carried out here is projected and formed towards the side from the 1 side of an insulating layer 6. 3h of terminal electrodes which consist of tip sides of 11h of lead sections is projected and formed in the upper part from the top face of an insulating layer 6 in the other flanks of the heat dissipation nature circuit board 10.

[0085] Moreover, if it does in this way and the metal radiator 4 is attached in one to the heat dissipation nature circuit board 10, after making generation of heat from the electronic parts mounted in the heat dissipation nature circuit board 10 transmit to the metal radiator 4 through the thermally conductive high insulating layer 6, heat can be efficiently radiated from this heat dissipation metal body 4, and heat dissipation nature can be improved further. if ** by which two or more radiation fins 5 were formed in one as a heat dissipation metal body here is used, it will be emitted from electronic parts and the heat transmitted to the metal radiator 4 through the circuit 7 and the insulating layer 6 will radiate heat still more efficiently from the metal radiator 4.

[0086] Drawing 6 shows the example of the heat dissipation nature exoergic components 9 formed using the prepreg 1 formed as mentioned above. In the example of illustration, after making the front face of exoergic components 9a, such as a power transistor, once carry out melting of the prepreg 1 by carrying out the laminating of prepreg 1 and the metal radiator 4 to order, and carrying out thermocompression bonding shaping within metal mold, while carrying out hardening shaping and forming the glue line 20 of high temperature conductivity in it with this hardening moldings, the metal radiator 4 is attached in the exoergic components 9 through this glue line 20. Moreover, after heating the metal radiator 4 beforehand, by sticking this metal radiator 4 to the exoergic components 9 by pressure through prepreg 1, melting postcure shaping of the prepreg 1 may be carried out, and a glue line 20 may be formed. Although prepreg 1 is constituted in this forming process, by once fusing, the glue line 20 fabricated will intervene without a clearance between the exoergic components 9 and the metal radiator 4, and transfer of the heat from the exoergic components 9 to the metal radiator 4 will be performed efficiently. Although what was formed in plate-like can also be used as a metal radiator 4, ** which two or more radiation fins 5 constitute from what was formed in one like the example of illustration is desirable, and is emitted from the exoergic components 9 in this case, and the heat transmitted to the metal radiator 4 by the glue line 20 radiates heat still more efficiently from the metal radiator 4. Thus, the unified high heat dissipation nature exoergic components 9 can be soldered to the circuit board etc. by the usual approach, and have the outstanding heat leakage nature. Therefore, in carrying out the screw stop of the

radiation fin to exoergic components [finishing / mounting in the circuit board like before etc.] through a heat dissipation silicon sheet etc. afterwards etc., time and effort [like] is not taken, a clearance can be made in the case of a screw stop, further, there is no risk of the heat dissipation effectiveness no longer being acquired enough, and such a conventional trouble can be improved sharply.
[0087] This metal radiator 4 like what is used in manufacture of the heat dissipation nature circuit board 10 Copper, aluminum, iron, the alloy that contains a kind at least among these metals, While it is desirable to form with at least one sort of quality of the materials chosen from the alloy which consists of the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, being hard coming to generate curvature etc. on the heat dissipation nature exoergic components 9 in this case and improving reinforcement Heat dissipation effectiveness can be improved. It is desirable to use iron, if priority is given to reinforcement for aluminum when attaining low-cost-izing and lightweight-ization here.
[0088]
[Example] Hereafter, this invention is explained in full detail according to an example.
[0089] In addition, the following were used as each component in Table 1.
- Coupling agent : Gamma-glycidoxypropyltrimetoxysilane and dispersant : Dai-Ichi Kogyo Seiyaku "A208F"
- MEK : A methyl ethyl ketone and DMF : Dimethylformamide cresol novolak mold resin : "ESCN195XL4" by Sumitomo Chemical Co., Ltd.
- Polyfunctional bisphenol A mold epoxy resin : "VG3101" by Mitsui Chemicals, Inc.
- Bisphenol A mold epoxy resin : "Epicoat 828" by oil-ized shell epoxy incorporated company
- Bisphenol female mold epoxy resin : "YDF8170" by Tohto Kasei Co., Ltd.
- Phenoxy resin : "YPP50" by Tohto Kasei Co., Ltd.
- Bromination bisphenol mold epoxy resin : "ESB400T" by Sumitomo Chemical Co., Ltd.
- Phenol novolak resin : "TAMANORU 752" by Gunei Chemical Industry Co., Ltd.
- hardening accelerator : the reactant of the tetra-phenyl HOSUFONIUMU tetraphenyl borate (TPPK) shown in a formula (1), and the phenol novolak resin shown in a formula (2) -- here The tetra-phenyl HOSUFONIUMU tetraphenyl borate (TPPK) 25 mass section which shows the above-mentioned hardening accelerator in a formula (1), The content of 70 mass % and a dicaryon (thing of n= 0) 10 mass %, [the content of three nuclides (thing of n= 1)] The content of four nuclides (thing of n= 2) the phenol novolak compound 80 mass section whose softening temperature 16 mass % and whose content of five or more (n= 3 or more things) nuclides are 5 mass %s is 63 degrees C It put into the 500ml stainless steel beaker, and the reactant (TPPK-A) of the homogeneity transparence brown obtained by agitating for 3 hours all over a 185-degree C oil bath was used.
[0090] Moreover, as a nonwoven glass fabric, the thickness of 372 micrometers and the mass of 53g per unit area which were formed from the glass fiber with a diameter [of 6 micrometers] and a die length of 13mm/the nonwoven glass fabric of m2 was used.
[0091] (Example 1) While doing 95 mass % content of the alumina which has particle size distribution as shown in Table 1, the slurry which has the presentation shown in Table 1 was kneaded with the planetary mixer. After adding the solvent to this and sinking into a nonwoven glass fabric after adjusting to the viscosity of 1500cP(s), it was made to dry and the prepreg 1 of B stage condition of the thickness of 400 micrometers and basis-weight 1250 g/m2 was produced. At the time of desiccation, consisted of three rooms, one room, two rooms with a die length of 6m, and die length of 4m with a die length of 4m, here. Using the vertical mold dryer, the temperature of one room was adjusted so that it might become the range of 60-70 degrees C about 110-120 degrees C and the temperature of three rooms in 60-70 degrees C and the temperature of two rooms, and it carried out by passing the nonwoven glass fabric into which the inside of this dryer infiltrated the slurry the rate for 1m/.
[0092] Three sheets of this prepreg 1 were used and the heat dissipation nature circuit board 10 was fabricated with the configuration shown in drawing 3 .
[0093] Here, a laminating is carried out to the order of the metal radiator 4 of 60x80mm, the 60x80mm prepreg 1 of two sheets, the leadframe 2 (leadframe 2a) of 80x100mm, the 60x80mm prepreg 1 of one

sheet, and the 80x100mm leadframe 2 (leadframe 2b). Moreover, each leadframe 2 was fabricated in the configuration as shown in drawing 3 , and formed opening 15 in the location equivalent to 7d of circuits which project from leadframe 2a in the prepreg 1 arranged between leadframe 2a and 2b. Moreover, thickness of a spacer 23 was set to 400 micrometers. In addition, the quality of the material and thickness of each part material are as being shown in Table 1.

[0094] these members were inserted into shaping metal mold, even the molding temperature of 175 degrees C was heated for 5 minutes with the compacting pressure of 40kg/cm2 (3.92MPa) under the high vacuum below 50Torr (6.7kPs), and it was made to harden -- back -- full hardening of the after-cure of 6 hours was performed and carried out at 175 degrees C. This produced the heat dissipation nature circuit board 10.

[0095] (Example 2) While doing 90 mass % content of the mixed filler of the alumimium nitride 60 mass section and the alumina 40 mass section which has particle size distribution as shown in Table 1, the slurry which has the presentation shown in Table 1 was kneaded with the planetary mixer, and the prepreg 1 with a thickness of 400 micrometers was produced still like the example 1.

[0096] Three sheets of this prepreg 1 were used and the heat dissipation nature circuit board 10 was fabricated with the configuration shown in drawing 5 .

[0097] Here, a laminating is carried out to the order of the metal radiator 4 of 60x80mm, the 60x80mm prepreg 1 of two sheets, and the 80x100mm leadframe 2. Moreover, each leadframe 2 was fabricated in the configuration as shown in drawing 5 , and set the height of the standing-up section 16 to 0.8mm. Moreover, opening 15 was formed in the location equivalent to the circuits 7f and 7h which project from a leadframe 2 in prepreg 1.

[0098] These members were inserted into shaping metal mold, and the heat dissipation nature circuit board 10 was produced on the same conditions as an example 1.

[0099] (Example 3) While doing 85 mass % content of the mixed filler of the alumina 55 mass section and the boron nitride (BN) 45 mass section which has the particle size distribution shown in Table 1, the slurry which has the presentation shown in Table 1 was kneaded with the planetary mixer, and the prepreg 1 with a thickness of 400 micrometers was produced still like the example 1. Except having carried out as three sheets of this prepreg 1 were used and the quality of the material and thickness of a leadframe 2 and the metal radiator 4 were shown in Table 1 Form each part material as shown in drawing 3 like an example 1, and it sets under the high vacuum below 50Torr (6.7kPs). After heating even the molding temperature of 175 degrees C for 5 minutes and stiffening it with the compacting pressure of 40kg/cm2 (3.92MPa), full hardening of the after-cure of 3 hours was performed and carried out at 200 degrees C. This produced the heat dissipation nature circuit board 10.

[0100] (Example 4) The slurry which has the presentation shown in Table 1 while doing 80 mass % content of the mixed filler of the magnesium-oxide (MgO) 35 mass section and the alumimium nitride (AlN) 65 mass section which has the particle size distribution shown in Table 1 was kneaded with the planetary mixer, and the prepreg 1 with a thickness of 400 micrometers was produced like the case of an example 1.

[0101] The metal radiator 4 which uses one sheet of this prepreg 1 and comes to form the radiation fin 5 with a height [of 10mm], and a width of face of 1mm in flat-surface dimension 10mmx10mm and a metal plate with a thickness of 2mm at one at intervals of 1mm, The prepreg 1 cut in the 10mmx10mm dimension and the transistor (exoergic components 9a) of a 10mmx10mmx5mm dimension are used. Carry out a laminating to the order of the metal radiator 4 with which the radiation fin 5 was formed, prepreg 1, and a transistor, insert into metal mold, and it sets under the high vacuum below 50Torr (6.7kPa). it heated for 5 minutes and was made to harden with the molding temperature of 175 degrees C with the compacting pressure of 20kg/cm2 (1.96MPa) -- back -- full hardening of the after-cure of 5 hours was performed and carried out at 175 degrees C. This produced the transistor (heat dissipation nature exoergic components 9) equipped with the radiation fin 5.

[0102] (Example 1 of a comparison) The silica which has the particle size distribution shown in Table 1 was made into 85 mass %, and the slurry was kneaded like the above. After it carried out vacuum suction of this slurry and it carried out degassing, the solvent was volatilized, and it applied to the PET

film in the comma coating machine after viscosity control at 15000cP(s), it dried further, and the heat dissipation nature sheet of B stage condition with a thickness of 400 micrometers was produced. Here, at the time of desiccation, using the horizontal-type dryer which consisted of two rooms, one room and die length of 4m with a die length of 4m, the temperature of one room was adjusted so that it might become the range of 110-120 degrees C about 60-70 degrees C and the temperature of two rooms, and it carried out by passing the PET film which applied the slurry for the inside of this dryer the rate for 0.1m/.

[0103] Two sheets of this heat dissipation nature sheet were used, and each part material was formed as the configuration of being shown in drawing 5 like the case of an example 2 except the point carried out as the quality of the material and thickness of the point of using this heat dissipation nature sheet instead of and a leadframe 2, and the metal radiator 4 were shown in Table 1. [prepreg 1] these members were inserted into molding metal mold, and it heated for 5 minutes with the molding temperature of 175 degrees C with the compacting pressure of 40kg/cm2 (3.92MPa) under the high vacuum below 50Torr (6.7kPa), and was made to harden -- back -- full hardening of the after-cure of 6 hours was performed and carried out at 175 degrees C. This produced the circuit board.

[0104] (Example 2 of a comparison) While doing 80 mass % content of the nitriding aluminum shown in Table 1, after kneading the primary slurry which has the presentation shown in Table 1 with a planetary mixer, the hyperviscous slurry was produced by carrying out the last kneading with 3 rolls.

[0105] After having added the solvent to this, adjusting to 15000cP(s) and applying to the thickness of 400 micrometers on a PET film in a comma coating machine, it dried and the heat dissipation nature sheet of B stage condition was produced. Here, it carried out by passing the PET film which applied the slurry for the inside of this dryer using the same dryer as the example 1 of a comparison at the time of desiccation the rate for 0.2m/.

[0106] Two sheets of this heat dissipation nature sheet are used, a laminating is carried out to the order of a griddle, a heat dissipation nature sheet, and a leadframe 2, with the compacting pressure of 50kg/cm2 (4.9MPa), with the molding temperature of 175 degrees C, it heated for 5 minutes and precure was carried out to the bottom of the high vacuum below 50Torr (6.7kPa). Full hardening of the after-cure of 6 hours was performed and carried out at 175 degrees C after that, and the circuit board was produced.

[0107]

[Table 1]

	実施例				比較例	
	1	2	3	4	1	2
クレゾールノボラックエポキシ樹脂	1.5		5.0		5.0	
多官能ビスフェノールA型エポキシ樹脂		3.2		8.0		8.0
ビスフェノールA型エポキシ樹脂	0.6	1.2				
ビスフェールF型エポキシ樹脂			1.6	0.9	1.6	0.9
フェノキシ樹脂	0.3	0.5	0.8	1.0	0.8	1.0
臭素化エポキシ樹脂	1.0	2.0	3.0	4.0	3.0	4.0
フェノールノボラック樹脂硬化剤	1.5	3.0	4.5	6.0	4.5	6.0
硬化促進剤	0.1	0.1	0.1	0.1	0.1	0.1
無機フィラー(wt%)	95 アルミナ	90 AlN／アルミナ	85 アルミナ／BN	80 MgO／AlN	85 SiO_2	80 AlN
平均粒径50～100μm	50	40	55	35	50	0
平均粒径5～30μm	40	50	35	55	50	100
平均粒径0.3～3μm	10	10	10	10	10	0
カップリング剤	0.9	0.8	0.9	0.9	0.9	0.9
分散剤	0.1	0.1	0.1	0.1	0.1	0.1
有機溶剤	アセトン	MEK	MEK	アセトン	MEK	MEK
基材	プリプレグ	プリプレグ	プリプレグ	プリプレグ	放熱性シート	放熱性シート
リードフレーム 厚み(mm)	0.2	0.5	1.0	(トランジスタ)	0.5	0.5
リードフレーム 材質	銅	アルミニウム	ジルコニウム銅合金		銅	アルミニウム
金属板 厚み(mm)	2.0	0.5			1.0	0.5
金属板 材質	アルミニウム	鉄			アルミニウム	鉄
放熱フィン 厚み(mm)			10	10		
放熱フィン 材質			アルミニウム	アルミニウム		

成分組成は樹脂組成物全量に対する割合を質量%で示し、無機フィラーの粒径ごとの組成は無機フィラー全量に対する割合を質量%で示したものである。

[0108] (Evaluation trial)
- The existence of generating of the chip of the end face of an insulating layer or a glue line when a shirring machine cuts uniformly similarly the prepreg 1 and the heat dissipation nature sheet which were produced in cutting workability evaluation each example and the example of a comparison was observed visually.
[0109] - The ratio to the prepreg 1 before desiccation of the decrement of the mass by the volatilization of a solvent at the time of leaving the prepreg 1 and the heat dissipation nature sheet which were produced in solvent volatility evaluation each example and the example of a comparison for 15 minutes, and drying them in a 160-degree C dryer, and the mass of a heat dissipation nature sheet was measured.
[0110] - It measured with the thermal conductimetry stationary monotonous comparison method. At this time, as a sample, the number-of-sheets laminating was carried out, it considered as 800-micrometer thickness, the prepreg 1 or the heat dissipation nature sheet used in each example and the example of a comparison was unified by [proper] carrying out heating pressing, the insulating layer 6 was formed as a 40x40mm veneer, and it measured per this veneer.
[0111] - Since the allowable-current evaluation allowable current was proportional to circuit thickness, it set the case of an example 1 to 1, and evaluated the allowable current from circuit thickness.
[0112] The above result is shown in Table 2.
[0113]
[Table 2]

	切断加工性	溶剤揮発分 (%)	熱伝導率 (W/mK)	許容電流量
実施例1	欠けなし	0.5	9	1
実施例2	〃	0.2	4	2
実施例3	〃	0.4	2	5
実施例4	〃	0.4	4	4
比較例1	欠け有り	1.3	2	2.5
比較例2	欠け有り	0.8	4	2

[0114]
[Effect of the Invention] The thermally conductive resin constituent applied to claim 1 of this invention as mentioned above The particle whose particles whose particles whose mean particle diameter is 50-100 micrometers are 30 - 60 mass section, and whose mean particle diameter is 5-30 micrometers are 30 - 60 mass section and the mean particle diameter of 0.1-3 micrometers blends 5 - 15 mass **** rare ****** filler 80 to 95% of the weight. In order to make the thermal conductivity of a hardened material into 3 - 10 W/mK, that hardening moldings by having high thermal conductivity and forming the glue line which pastes up the insulating layer of the circuit board, and exoergic components and the metal body for heat dissipation with this hardening moldings High heat dissipation nature can be given to the circuit board and exoergic components.
[0115] Invention concerning claim 2 in the configuration of claim 1 Moreover, in addition, the epoxy resin which has two or more epoxy groups in 1 intramolecular, The phenol system resin which has two or more phenolic hydroxyl groups in 1 intramolecular as a curing agent, Since a reactant with the phenol system compound which has two or more phenolic hydroxyl groups in 1 intramolecular shown in the phosphine system compound shown in the above-mentioned formula (1) as a hardening accelerator and the above-mentioned formula (2) is contained, The reaction of an epoxy resin and a curing agent can be prevented from almost progressing during desiccation of a solvent. In producing prepreg with this thermally conductive resin constituent, it becomes what has flexibility, and moreover at the time of hardening shaping, hardening becomes possible in a short time, and the rigidity immediately after shaping is high.
[0116] Moreover, the heat dissipation nature of the circuit board can be improved, these fillers are excellent in thermal conductivity using a kind or two sorts or more of things as which invention concerning claim 3 was chosen from aluminum 2O3, and MgO, BN, AlN and SiO2 as an inorganic filler in addition to claim 1 or the configuration of 2, and the grain-size design for forming high restoration is [there is a degree of freedom at particle size distribution, and] still easier.
[0117] The prepreg concerning claim 4 of this invention to the nonwoven fabric of 20 which consists of 10-25mm inorganic fiber ingredients in the fiber diameter of 6-20 micrometers, and fiber length - 200 g/m2 In order to sink in and dry and to make into a semi-hardening condition the resin varnish which blends a solvent with a thermally conductive resin constituent according to claim 1 to 3, and is obtained, While high-filling up with an inorganic filler, homogeneity will distribute and the good prepreg of handling nature will be obtained. The shaping hardened material will have the outstanding thermal conductivity, forms formation of the insulating layer of the circuit board, and the glue line for attaching a heat dissipation nature metal body in exoergic components, and in order to fabricate the insulating Plastic solid for which heat dissipation nature is needed, it can use them suitably. Since the carrier film is not prepared in one side as compared with the heat dissipation nature sheet obtained by the resin film etc. by carrying out spreading desiccation of the resin constituent, moreover, at the time of formation of prepreg By the solvent volatilization from both sides being possible, desiccation speed being quick, and uniform desiccation hardening being possible, and using a nonwoven fabric base material While forming in the shape of a sheet, it can form in the sticky quality of the material, and handling nature becomes very good, and it is hard to generate a chip etc. at the time of processing of cutting etc. Moreover, since there is no carrier film, it is easy to carry out processing of cutting etc. Furthermore, only a part with a carrier film unnecessary also in cost can reduce a manufacturing cost, and can reduce the manufacturing

cost especially in the desiccation conversion cost of resin. Moreover, although silicon etc. is generally used for mold-release characteristic grant with a heat dissipation nature sheet and a carrier film when using a carrier film, such a release agent also becomes unnecessary, a release agent may stop remaining, and it excels in an adhesive property with a leadframe.

[0118] While the heat dissipation nature circuit board concerning claim 5 of this invention carries out the shaping unification of prepreg according to claim 4 and at least one leadframe In order for a part of at least one leadframe to project or be outside exposed from the insulating layer fabricated in prepreg, Can give high thermal conductivity to an insulating layer, can radiate heat efficiently in generation of heat from the electronic parts mounted in this heat dissipation nature circuit board, and the part exposed [which exposes and projects] from the insulating layer of a leadframe is formed as a terminal electrode. Connection with external wiring becomes easy, and it sets to a forming process. The fiber of the nonwoven fabric which constitutes prepreg will be easily cut according to a flow of a thermally conductive resin constituent. A flow of resin will not be barred, the fiber cut at this time will be distributed by homogeneity in an insulating layer, and the mechanical strength of the insulating layer fabricated in prepreg will improve. Moreover, since the carrier film is not prepared in one side as compared with the case where an insulating layer is fabricated with the heat dissipation nature sheet obtained by the resin film etc. by carrying out spreading desiccation of the resin constituent By the solvent volatilization from both sides being possible, desiccation speed being quick at the time of formation of prepreg, and uniform desiccation hardening being possible to it, and using a nonwoven fabric base material for it While forming in the shape of a sheet, it can form in the sticky quality of the material, and handling nature becomes very good, and it is hard to generate a chip etc. at the time of processing of cutting etc. Moreover, since there is no carrier film, it is easy to carry out processing of cutting etc. Furthermore, only a part with a carrier film unnecessary also in cost can reduce a manufacturing cost, and can reduce the manufacturing cost especially in the desiccation conversion cost of resin. Moreover, although silicon etc. is generally used for mold-release characteristic grant with a heat dissipation nature sheet and a carrier film when using a carrier film, such a release agent becomes unnecessary and the problem of the imprint to the heat dissipation nature sheet of a release agent is also lost. Moreover, although a heat dissipation nature sheet must be exfoliated from a carrier film at the time of shaping of the heat dissipation nature circuit board, if prepreg is used, it will not take such time and effort. Furthermore, a leadframe can be formed thickly, the thickness of a circuit can be formed greatly, and high current-ization can be attained easily.

[0119] Moreover, while invention concerning claim 6 carries out the shaping unification of a metal radiator, prepreg according to claim 4, and at least one leadframe in addition to a configuration according to claim 5 In order for a part of at least one leadframe to project or be outside exposed from the insulating layer fabricated in prepreg, The part projected or exposed from the insulating layer of a leadframe is formed as a terminal electrode. After making generation of heat from the electronic parts which the connection with external wiring became easy, and were mounted in the heat dissipation nature circuit board transmit to a metal radiator through a thermally conductive high insulating layer, heat can be efficiently radiated from this metal radiator, and heat dissipation nature can be improved further.

[0120] Moreover, since invention concerning claim 7 uses that by which the radiation fin was formed in one as a metal radiator in addition to the configuration of claim 6, it can improve the heat dissipation effectiveness from a metal radiator, and can improve further the heat dissipation nature of the heat dissipation nature circuit board.

[0121] Moreover, since invention concerning claim 8 forms a leadframe with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material in addition to the configuration of claim 5 thru/or either of 7, it can design heat dissipation nature and reinforcement if needed.

[0122] Moreover, since invention concerning claim 9 forms a metal radiator with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal

material, and two or more sorts of metal material in addition to claim 6 or the configuration of 7, it can obtain the circuit board which designed heat dissipation nature and reinforcement to arbitration.
[0123] Moreover, while invention concerning claim 10 is formed in a leadframe in addition to the configuration of claim 5 thru/or either of 9 Where an enveloping layer is formed in the front face of the circuit exposed on the surface of an insulating layer at the time of shaping, in order to carry out the shaping unification of a leadframe and the prepreg according to claim 4, The weld flash of the resin hardened material with which the resin of prepreg fused in the heating pressurization process hardens, and is formed in the condition of turning to the enveloping layer In case an enveloping layer is removed, it can remove together, and adhesion of the weld flash of the resin hardened material in a circuit can be prevented, the solder wettability of a circuit can be improved, and solder mounting nature can be improved.
[0124] Invention concerning claim 11 in the configuration of claim 5 thru/or either of 9 Moreover, in order [in addition,] to form two or more weld flash with a height of 0.1-2mm in the periphery of the circuit exposed on the surface of an insulating layer at the time of shaping formed in the leadframe, This weld flash is crushed in a heating pressurization process, and heights are formed. By these heights It can prevent that the fused resin of prepreg flows on a circuit front face, and adhesion of the weld flash of the resin hardened material in a circuit can be prevented, the solder wettability of a circuit can be improved, and solder mounting nature can be improved.
[0125] Moreover, the heat dissipation nature exoergic components concerning claim 12 of this invention In order to carry out the laminating unification of exoergic components, prepreg according to claim 4, and the metal radiator at order, A metal radiator can be attached in exoergic components through the thermally conductive high glue line in which hardening shaping is carried out and prepreg is formed. While transmitting generation of heat from exoergic components to a metal radiator efficiently through a glue line, heat can be efficiently radiated from a metal radiator, and the high heat dissipation nature exoergic components of heat dissipation nature can be obtained. Moreover, since a metal radiator is beforehand prepared in one in this way, it is not necessary to prepare a metal radiator by post processing after mounting at the time of mounting to the circuit board etc., and a mounting process can be made simple at it. Moreover, since the carrier film is not prepared in one side as compared with the case where an insulating layer is fabricated with the heat dissipation nature sheet obtained by the resin film etc. by carrying out spreading desiccation of the resin constituent By the solvent volatilization from both sides being possible, desiccation speed being quick at the time of formation of prepreg, and uniform desiccation hardening being possible to it, and using a nonwoven fabric base material for it While forming in the shape of a sheet, it can form in the sticky quality of the material, and handling nature becomes very good, and it is hard to generate a chip etc. at the time of processing of cutting etc. Moreover, since there is no carrier film, it is easy to carry out processing of cutting etc. Furthermore, only a part with a carrier film unnecessary also in cost can reduce a manufacturing cost, and can reduce the manufacturing cost especially in the desiccation conversion cost of resin. Moreover, when using a carrier film, generally silicon etc. is used for mold-release characteristic grant with a heat dissipation nature sheet and a carrier film, but while such a release agent becomes unnecessary, the problem of the imprint to the heat dissipation nature sheet of a release agent is also lost, and it becomes the thing excellent in the adhesion of the insulating layer and leadframe which consist of prepreg. Moreover, although a heat dissipation nature sheet must be exfoliated from a carrier film at the time of shaping of a heat dissipation nature heating element, if prepreg is used, it will not take such time and effort.
[0126] Moreover, since invention concerning claim 13 uses that by which the radiation fin was formed in one as a metal radiator in addition to the configuration of claim 12, it can improve the heat dissipation effectiveness from a metal radiator, and can improve further the heat dissipation nature of the heat dissipation nature circuit board.
[0127] Moreover, since invention concerning claim 14 forms a metal radiator with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material in addition to claim 12 or the configuration of 13, it

can design heat dissipation nature and reinforcement if needed.

[Translation done.]

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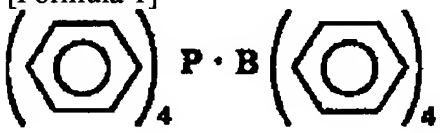
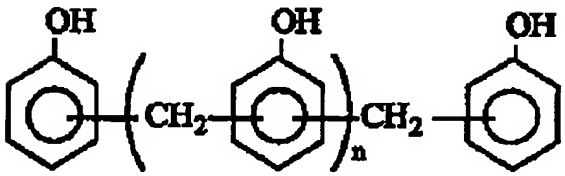
CLAIMS

[Claim(s)]
[Claim 1] The thermally conductive resin constituent characterized by for the particle whose particles whose particles whose mean particle diameter is 50-100 micrometers are 30 - 60 mass section, and whose mean particle diameter is 5-30 micrometers are 30 - 60 mass section and the mean particle diameter of 0.1-3 micrometers blending 5 - 15 mass **** rare ****** filler 80 to 95% of the weight, and changing considering the thermal conductivity of a hardened material as 3 - 10 W/mK.
[Claim 2] The thermally conductive resin constituent according to claim 1 characterized by containing a reactant with the phenol system compound which has two or more phenolic hydroxyl groups in 1 intramolecular shown in the epoxy resin which has two or more epoxy groups in 1 intramolecular, the phenol system resin which has two or more phenolic hydroxyl groups in 1 intramolecular as a curing agent, the phosphine system compound shown in the following type (1) as a hardening accelerator, and the following formula (2).
[Formula 1]



… (1)



… (2)

(但し、nは0以上の整数)

[Claim 3] The thermally conductive resin constituent according to claim 1 or 2 characterized by changing as an inorganic filler using aluminum 2O3, a kind chosen from MgO, BN, AlN, and SiO2, or two sorts or more of things.
[Claim 4] Prepreg characterized by sinking in, drying the resin varnish which blends a solvent with a thermally conductive resin constituent according to claim 1 to 3, and is obtained to the nonwoven fabric of 20 which consists of 10-25mm inorganic fiber ingredients in the fiber diameter of 6-20 micrometers, and fiber length - 200 g/m2, and growing into it as a semi-hardening condition.
[Claim 5] The heat dissipation nature circuit board characterized by the thing which project and have a

part of at least one leadframe outside from the insulating layer fabricated in prepreg while carrying out the shaping unification of prepreg according to claim 4 and at least one leadframe, and which it is, and is exposed and changed.

[Claim 6] The heat dissipation nature circuit board characterized by for a part of at least one leadframe projecting outside from the insulating layer fabricated in prepreg, or being exposed, and changing while carrying out the shaping unification of a metal radiator, prepreg according to claim 4, and at least one leadframe.

[Claim 7] The heat dissipation nature circuit board according to claim 6 characterized by a radiation fin changing using what was formed in one as a metal radiator.

[Claim 8] The heat dissipation nature circuit board according to claim 5 to 7 characterized by forming a leadframe with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, and changing.

[Claim 9] The heat dissipation nature circuit board according to claim 6 or 7 characterized by forming a metal radiator with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, and changing.

[Claim 10] The heat dissipation nature circuit board according to claim 5 to 9 characterized by carrying out the shaping unification of a leadframe and the prepreg according to claim 4, and growing into the front face of the circuit exposed on the surface of an insulating layer at the time of shaping where an enveloping layer is formed while being formed in a leadframe.

[Claim 11] The heat dissipation nature circuit board according to claim 5 to 9 characterized by forming two or more weld flash with a height of 0.1-2mm in the periphery of the circuit exposed on the surface of an insulating layer at the time of shaping formed in the leadframe, and growing into it.

[Claim 12] The heat dissipation nature exoergic components characterized by carrying out the laminating unification of exoergic components, prepreg according to claim 4, and the metal radiator at order, and changing.

[Claim 13] The heat dissipation nature exoergic component according to claim 12 characterized by a radiation fin changing as a metal radiator using what was formed in one.

[Claim 14] The heat dissipation nature exoergic component according to claim 12 or 13 characterized by forming a metal radiator with at least one sort of quality of the materials chosen from the alloy which consists of copper, aluminum, iron, the alloy that contains a kind at least among these metals, the clad plate which consists of two or more sorts of metal material, and two or more sorts of metal material, and changing.

[Translation done.]